

# DEPARTMENT OF MATHEMATICS

Ma 162 Third (practice) Exam April 8, 2013

**Instructions:** No cell phones or network-capable devices are allowed during the exam. The test has been carefully checked and its notation is consistent with the homework problems and practice exam. No additional details will be provided during the exam.

Problem	Maximum Score	Actual Score
1	20	
2	20	
3	20	
4	20	
5	10	
6	10	
Total	100	

NAME: \_\_\_\_\_ Section: \_\_\_\_\_

Last four digits of Student ID: \_\_\_\_\_

- Simple Interest:  $I = Prt$ . Accumulation:  $A = P(1 + rt)$ .
- Compound Interest Accumulation:  $A = P(1 + i)^n$ . Present value:  $P = A(1 + i)^{-n}$ .
- Effective rate:  $r_{eff} = (1 + \frac{r}{m})^m - 1$ .
- Annuity: Sum:  $S = R \frac{(1+i)^n - 1}{i}$ . Present value:  $P = R \frac{1 - (1+i)^{-n}}{i}$ .
- Set counting: Two sets:  $n(A \cup B) = n(A) + n(B) - n(A \cap B)$   
 $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(C \cap A) + n(A \cap B \cap C)$ .

1. Basic time value of money. Multiple choice. Work is not graded. Clearly indicate the most correct choice in each row of answers. Unclear indications are worth no credit.

(on the real exam only one row of answers per problem, and the order of the questions will be scrambled).

\$2,437.00 is invested in an account earning a nominal interest rate of 1.50% APR compounded bi-weekly. How much is the account worth after 5 years?

- |                |                 |                  |                    |                     |
|----------------|-----------------|------------------|--------------------|---------------------|
| (a) \$2,626.00 | (b) \$2,626.25  | (c) \$2,626.50   | (d) \$2,626.75     | (e) \$2,627.00      |
| (a) \$2,626.75 | (b) \$26,267.47 | (c) \$262,674.69 | (d) \$2,626,746.87 | (e) \$26,267,468.68 |
| (a) \$19.46    | (b) \$2,260.96  | (c) \$2,437.00   | (d) \$305,136.40   | (e) \$328,894.57    |
| (a) \$2,625.34 | (b) \$2,626.44  | (c) \$2,626.68   | (d) \$2,626.75     | (e) \$2,626.78      |

How much needs to be invested in an account earning a nominal interest rate of 1.50% APR compounded quarterly in order for the account to be worth \$1,373.10 after 9 years?

- |                |                |                |                 |                 |
|----------------|----------------|----------------|-----------------|-----------------|
| (a) \$1,199.50 | (b) \$1,199.75 | (c) \$1,200.00 | (d) \$1,200.25  | (e) \$1,200.50  |
| (a) \$0.12     | (b) \$1.20     | (c) \$12.00    | (d) \$120.00    | (e) \$1,200.00  |
| (a) \$40.85    | (b) \$1,200.00 | (c) \$1,373.10 | (d) \$46,159.31 | (e) \$52,817.69 |
| (a) \$1,200.90 | (b) \$1,200.00 | (c) \$1,199.80 | (d) \$1,199.74  | (e) \$1,199.72  |

How long does \$75.00 need to be invested in an account earning a nominal interest rate of 1.50% APR compounded monthly in order for the account to be worth \$87.13?

- |                |                |               |              |              |
|----------------|----------------|---------------|--------------|--------------|
| (a) 7 years    | (b) 8 years    | (c) 9 years   | (d) 10 years | (e) 11 years |
| (a) 0.16 years | (b) 0.63 years | (c) 2.5 years | (d) 10 years | (e) 40 years |

If \$75.00 is invested monthly in an account earning a nominal interest rate of 1.50% APR compounded monthly. How much is the account worth in 6 years?

- |                |                |                |                 |                  |
|----------------|----------------|----------------|-----------------|------------------|
| (a) \$5,646.77 | (b) \$5,647.02 | (c) \$5,647.27 | (d) \$5,647.52  | (e) \$5,647.77   |
| (a) \$56.47    | (b) \$564.68   | (c) \$5,646.77 | (d) \$56,467.67 | (e) \$564,676.74 |
| (a) \$1.09     | (b) \$68.55    | (c) \$75.00    | (d) \$5,161.05  | (e) \$5,646.77   |
| (a) \$467.22   | (b) \$1,879.80 | (c) \$5,646.77 | (d) \$12,238.97 | (e) \$24,481.62  |

How much must be invested in an account earning a nominal interest rate of 1.50% APR compounded monthly, in order to withdraw \$75.00 monthly for 7 years?

- |                |                 |                  |                    |                     |
|----------------|-----------------|------------------|--------------------|---------------------|
| (a) \$5,976.49 | (b) \$5,976.74  | (c) \$5,976.99   | (d) \$5,977.24     | (e) \$5,977.49      |
| (a) \$5,976.99 | (b) \$59,769.86 | (c) \$597,698.65 | (d) \$5,976,986.45 | (e) \$59,769,864.52 |
| (a) \$0.94     | (b) \$67.53     | (c) \$75.00      | (d) \$5,976.99     | (e) \$6,638.27      |

How long must monthly payments of \$175.00 be invested in an account earning a nominal interest rate of 1.50% APR compounded monthly in order for the account to be worth \$17,837.73 by the end?

- |             |              |               |               |                 |
|-------------|--------------|---------------|---------------|-----------------|
| (a) 5 years | (b) 6 years  | (c) 7 years   | (d) 8 years   | (e) 9 years     |
| (a) 8 years | (b) 32 years | (c) 128 years | (d) 512 years | (e) 2,048 years |

2. Basic time value of money. Multiple choice. Work is not graded. Clearly indicate the most correct choice in each row of answers. Unclear indications are worth no credit.

(on the real exam only one row of answers per problem, and the order of the questions will be scrambled).

\$2,437.00 is invested in an account earning a nominal interest rate of 15.00% APR compounded bi-weekly. How much is the account worth after 5 years?

- |                |                |                |                  |                  |
|----------------|----------------|----------------|------------------|------------------|
| (a) \$5,147.77 | (b) \$5,148.02 | (c) \$5,148.27 | (d) \$5,148.52   | (e) \$5,148.77   |
| (a) \$0.51     | (b) \$5.15     | (c) \$51.48    | (d) \$514.80     | (e) \$5,148.02   |
| (a) \$26.70    | (b) \$1,153.64 | (c) \$2,437.00 | (d) \$222,448.91 | (e) \$469,910.51 |
| (a) \$4,901.68 | (b) \$5,088.83 | (c) \$5,135.20 | (d) \$5,148.02   | (e) \$5,153.56   |

How much needs to be invested in an account earning a nominal interest rate of 15.00% APR compounded quarterly in order for the account to be worth \$4,515.99 after 9 years?

- |                |                |                |                 |                  |
|----------------|----------------|----------------|-----------------|------------------|
| (a) \$1,200.00 | (b) \$1,200.25 | (c) \$1,200.50 | (d) \$1,200.75  | (e) \$1,201.00   |
| (a) \$12.00    | (b) \$120.00   | (c) \$1,200.00 | (d) \$12,000.00 | (e) \$120,000.00 |
| (a) \$230.63   | (b) \$1,200.00 | (c) \$4,515.99 | (d) \$88,426.42 | (e) \$332,777.41 |
| (a) \$1,283.73 | (b) \$1,200.00 | (c) \$1,180.56 | (d) \$1,175.28  | (e) \$1,173.00   |

How long does \$75.00 need to be invested in an account earning a nominal interest rate of 15.00% APR compounded monthly in order for the account to be worth \$333.02?

- |                |                |               |              |              |
|----------------|----------------|---------------|--------------|--------------|
| (a) 8 years    | (b) 9 years    | (c) 10 years  | (d) 11 years | (e) 12 years |
| (a) 0.16 years | (b) 0.63 years | (c) 2.5 years | (d) 10 years | (e) 40 years |

If \$75.00 is invested monthly in an account earning a nominal interest rate of 15.00% APR compounded monthly. How much is the account worth in 6 years?

- |                |                 |                  |                    |                     |
|----------------|-----------------|------------------|--------------------|---------------------|
| (a) \$8,674.77 | (b) \$8,675.02  | (c) \$8,675.27   | (d) \$8,675.52     | (e) \$8,675.77      |
| (a) \$8,675.52 | (b) \$86,755.22 | (c) \$867,552.16 | (d) \$8,675,521.61 | (e) \$86,755,216.09 |
| (a) \$1.59     | (b) \$30.66     | (c) \$75.00      | (d) \$3,546.94     | (e) \$8,675.52      |
| (a) \$656.53   | (b) \$2,838.88  | (c) \$8,675.52   | (d) \$18,892.25    | (e) \$37,866.88     |

How much must be invested in an account earning a nominal interest rate of 15.00% APR compounded monthly, in order to withdraw \$75.00 monthly for 7 years?

- |                |                |                 |                  |                    |
|----------------|----------------|-----------------|------------------|--------------------|
| (a) \$3,885.91 | (b) \$3,886.16 | (c) \$3,886.41  | (d) \$3,886.66   | (e) \$3,886.91     |
| (a) \$388.67   | (b) \$3,886.66 | (c) \$38,866.64 | (d) \$388,666.39 | (e) \$3,886,663.90 |
| (a) \$1.45     | (b) \$26.42    | (c) \$75.00     | (d) \$3,886.66   | (e) \$11,034.68    |

How long must monthly payments of \$175.00 be invested in an account earning a nominal interest rate of 15.00% APR compounded monthly in order for the account to be worth \$32,137.19 by the end?

- |             |              |               |               |                 |
|-------------|--------------|---------------|---------------|-----------------|
| (a) 5 years | (b) 6 years  | (c) 7 years   | (d) 8 years   | (e) 9 years     |
| (a) 8 years | (b) 32 years | (c) 128 years | (d) 512 years | (e) 2,048 years |

3. Basic counting. Multiple choice. Work is not graded. Clearly indicate the most correct choice in each row of answers. Unclear indications are worth no credit.

The real exam may have fairly different word problems, but they will test the same concepts in roughly the same way.

Let  $H$  be the set of bears who eat honey, and let  $F$  be the set of bears who eat fish. What is the most accurate description of  $H - F = H \cap F^c$ ?

- (a) The set of fish that are not eaten by bears
- (b) The set of bears that are not eaten by fish
- (c) The set of bears that eat honey and fish
- (d) The set of bears that eat honey but not fish
- (e) The set of bears that eat honey or fish or both

70% of the class watches Arrested Development and 60% watches Battlestar Galactica. 10% watches neither of those, but watches Downton Abbey. What percentage of the class watches both Arrested Development and Battlestar Galactica?

- (a) 10%
- (b) 40%
- (c) 50%
- (d) 60%
- (e) 70%
- (f) 130%

70% of dancers at the club like Pop music, 60% like House music and 50% like Dubstep. 30% like Pop and House, 25% like House and Dubstep, and 20% like Pop and Dubstep. What percentage of dancers like all three types of music?

- (a) 1%
- (b) 5%
- (c) 10%
- (d) 20%
- (e) 80%

Taylor Swift has released four albums. Assuming nobody owns more than one copy of any album, how many different collections of these albums are possible? (For example, a person might own all four, or none at all, or only the first one.)

- (a) 4
- (b) 6
- (c) 8
- (d) 12
- (e) 16
- (f) 20

Taco Bell is offering a taste test of three featured products (including the new Cool Ranch Doritos Locos Taco!) and participants are asked to fill out a survey, marking each food as Good, Bad, or Not Tasted. How many different survey results are possible? (For example, one result would be having all foods marked as Good.)

- (a) 3
- (b) 9
- (c) 18
- (d) 27
- (e) 33

How many ways are there to rearrange the letters of the word BUSINESS?

- (a) 6720
- (b) 13440
- (c) 20160
- (d) 40320
- (e) 208827064576

How many ways are there to rearrange the letters of the word HIPPOPOTAMUS?

- (a) 12
- (b) 362880
- (c) 39916800
- (d) 79833600
- (e) 119750400

4. Gambler's Ruin. Multiple choice. Work is not graded. Clearly indicate the most correct choice in each row of answers. Unclear indications are worth no credit.

The real exam may have fairly different word problems, but they will test the same concepts in roughly the same way.

To win the trifecta in the 6th race at Keeneland you must pick the winning horse, the second place horse and the third place horse in the correct order. If there are 10 horses in the race, how many trifecta bets must you place in order to guarantee that you will have a winning ticket?

- (a) 10                      (b) 120                      (c) 720                      (d) 1000                      (e) 40320                      (f) 3628800

To win a boxed trifecta you must pick some horses that include the first, second, and third place horses, but not necessarily in the correct order and it is ok if you have some extra horses. How many regular trifecta bets do you need to make in order to cover the same winning possibilities as a single boxed trifecta bet with 5 horses in it? You may assume 10 horses are in the race.

- (a) 3                              (b) 5                              (c) 10                              (d) 60                              (e) 120

A 52-card deck is dealt out evenly to four players. The first player reveals they have all of the "royalty" ( $J\heartsuit, J\diamondsuit, J\clubsuit, J\spadesuit, Q\heartsuit, Q\diamondsuit, Q\clubsuit, Q\spadesuit, K\heartsuit, K\diamondsuit, K\clubsuit, K\spadesuit$ ). How many possibilities are there for the first player's hand?

- (a) 1                              (b) 4                              (c) 9                              (d) 12                              (e) 40                              (f) 52

As before, a 52-card deck is dealt out evenly to four players. The first player reveals they have all of the "face cards" ( $J\heartsuit, J\diamondsuit, J\clubsuit, J\spadesuit, Q\heartsuit, Q\diamondsuit, Q\clubsuit, Q\spadesuit, K\heartsuit, K\diamondsuit, K\clubsuit, K\spadesuit$ ). The second player reveals they have the rest of the  $\spadesuit$  cards. How many possibilities remain for the first player's hand?

- (a) 1                              (b) 4                              (c) 8                              (d) 13                              (e) 30                              (f) 51

As before, a 52-card deck is dealt out evenly to four players. The first player reveals they have all of the "face cards" ( $J\heartsuit, J\diamondsuit, J\clubsuit, J\spadesuit, Q\heartsuit, Q\diamondsuit, Q\clubsuit, Q\spadesuit, K\heartsuit, K\diamondsuit, K\clubsuit, K\spadesuit$ ). The second player reveals they have the rest of the  $\spadesuit$  cards. How many possibilities remain for the second player's hand?

- (a) 1                              (b) 3                              (c) 30                              (d) 4060                              (e) 27000

Two six-sided dice are rolled, one white and one black. How many ways are there to get a total of 8 on the two dice?

- (a) 1                              (b) 4                              (c) 5                              (d) 6                              (e) 7                              (f) 8

You must show work to gain credit. Answers without justification receive no credit.

5. \$100 is invested every month for five years into an account earning a nominal interest rate of 12% APR compounded monthly for the first three years, and 18% APR compounded monthly for the last two years.

(a) How much is the account worth at the end of the five years?

(b) How much would one need to invest (in an account earning the same interest rates) at the beginning of the five years (as a single payment) in order to have \$10,000 by the end of the five years?

You must show work to gain credit. Answers without justification receive no credit.

6. (a) How many ways are there to arrange 3 letters from the word HIPPOPOTAMUS?

(b) If you roll three six-sided dice (one white, one red, one blue), how many ways are there to get “doubles” but not “triples”? (That is, two of the three numbers rolled are the same and one of the three is different.)